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(54) Fall arrest device

(57) A fall arrest device comprising a main drum (16) journalled within a housing (10) and carrying a lifeline (18) which can be withdrawn from and returned to the drum against and by a spring (22), respectively. Also journalled within the housing (10) is a sub-shaft (34) which is arranged to be coupled to the main drum (16) for rotation therewith only in one direction of drum rotation corresponding to withdrawal of lifeline (18). A centrifugally acting brake on the sub-shaft controls the speed of rotation of the sub-shaft and hence of the main drum (16). A back-up brake is included for stopping rotation of the drum (16) in a controlled manner should the speed of rotation of the drum in said one direction exceed a predetermined magnitude.

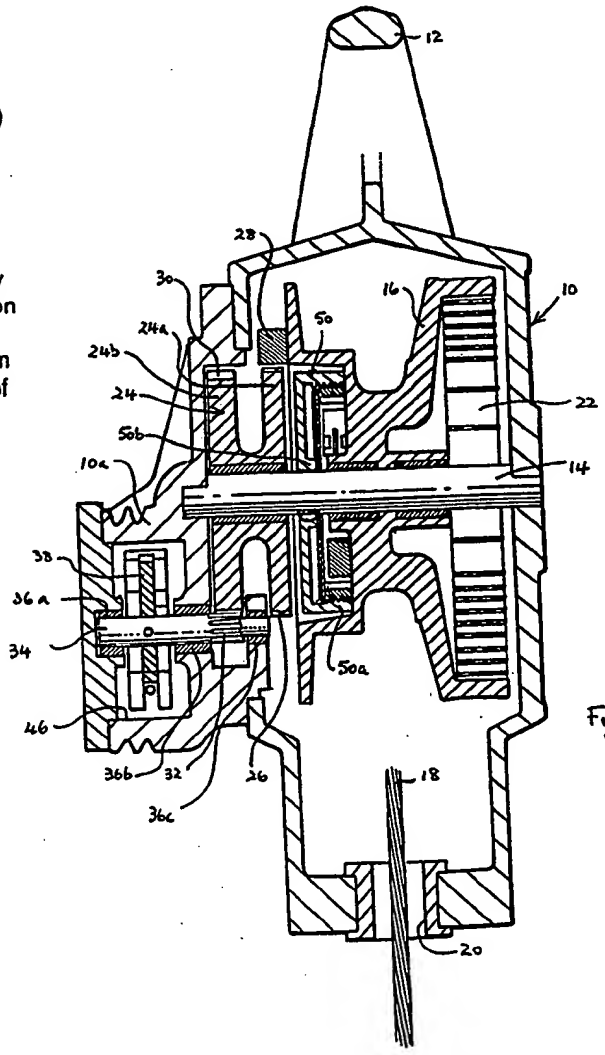

Fig.1

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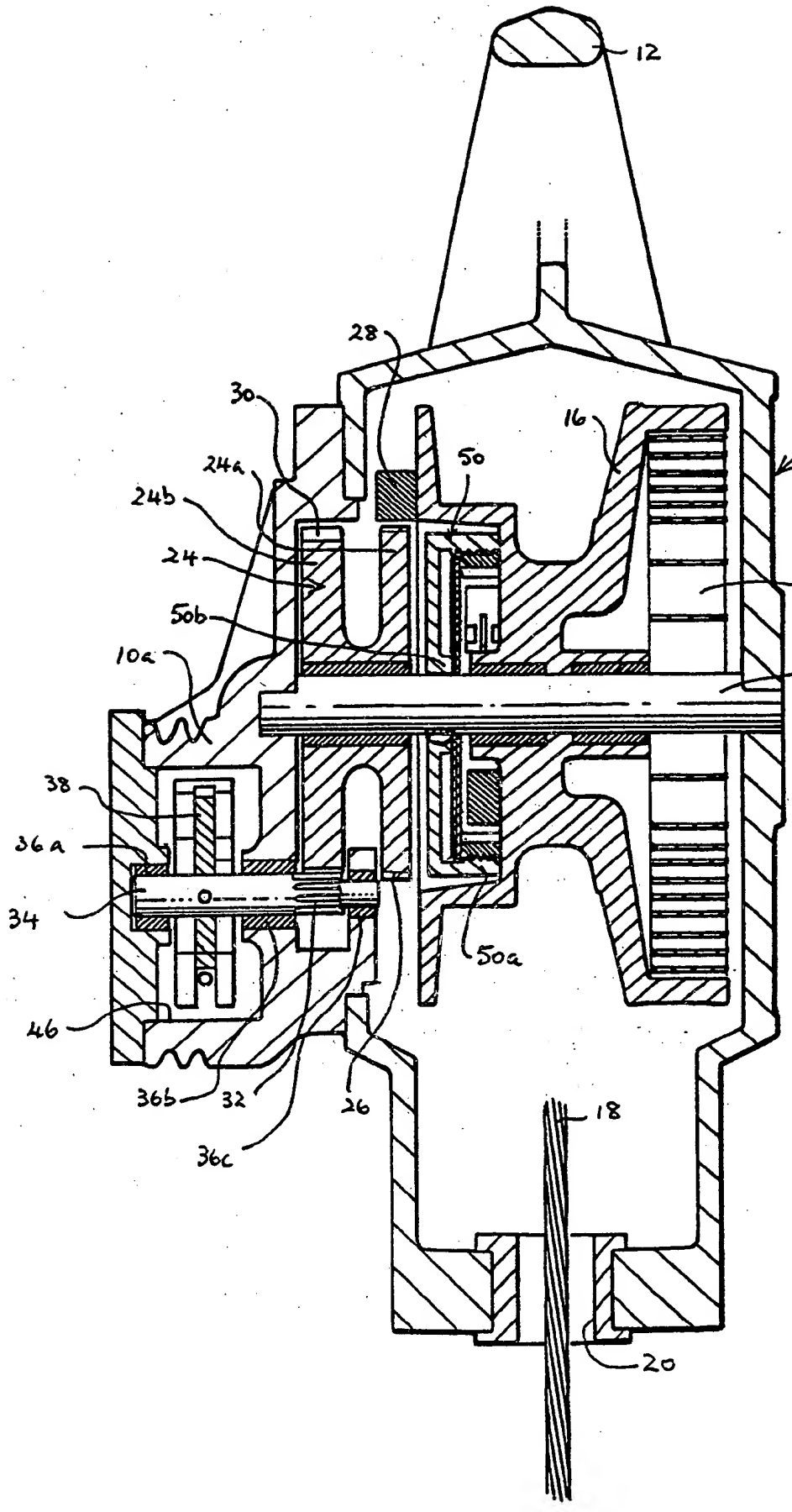
12
28
30
16
10
24a
50
24b
24
22
50b
10a
14
38
36a
34
50a
46
36b
32
26
18
36c
20

Fig. 1

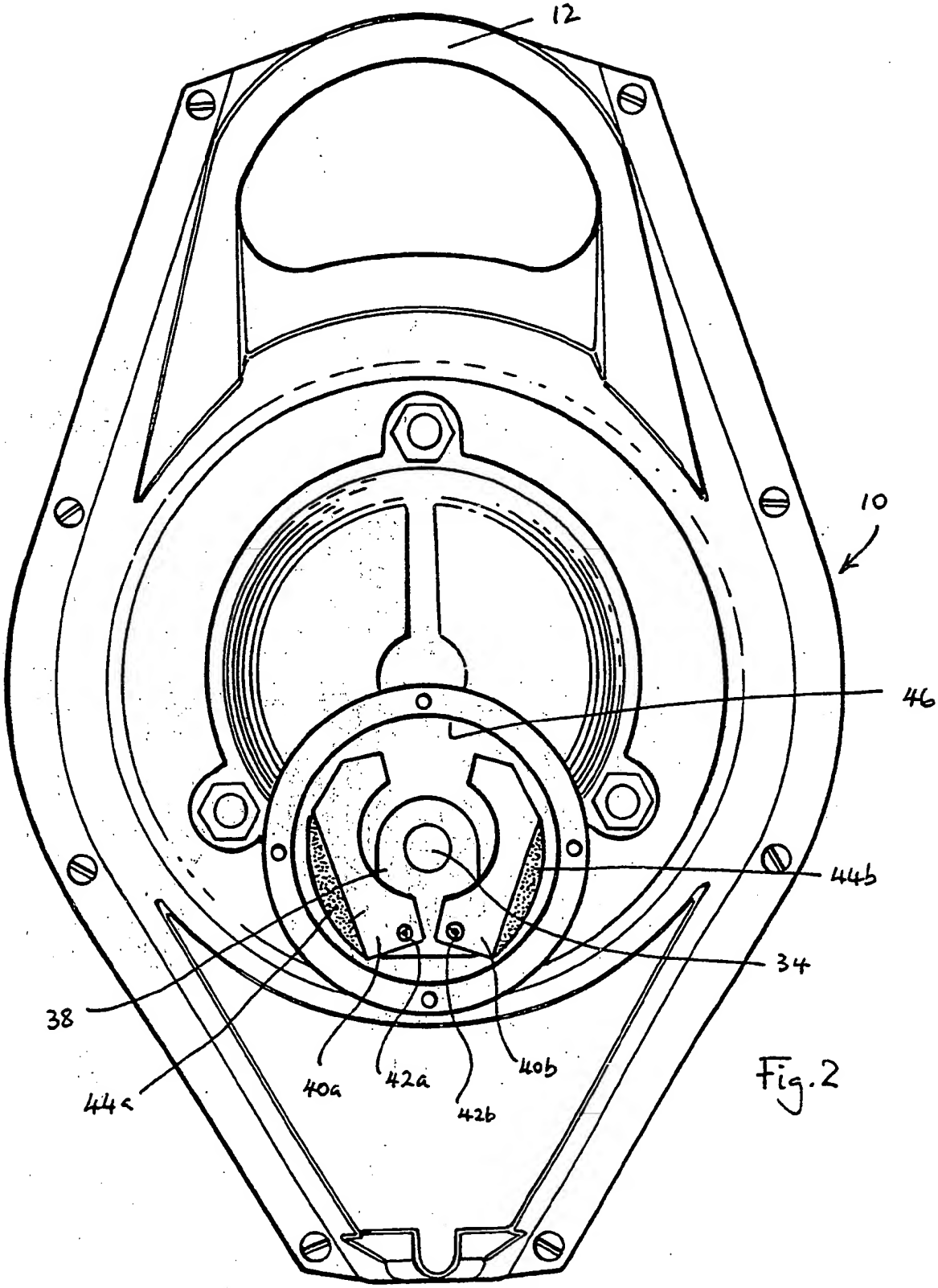

Fig. 2

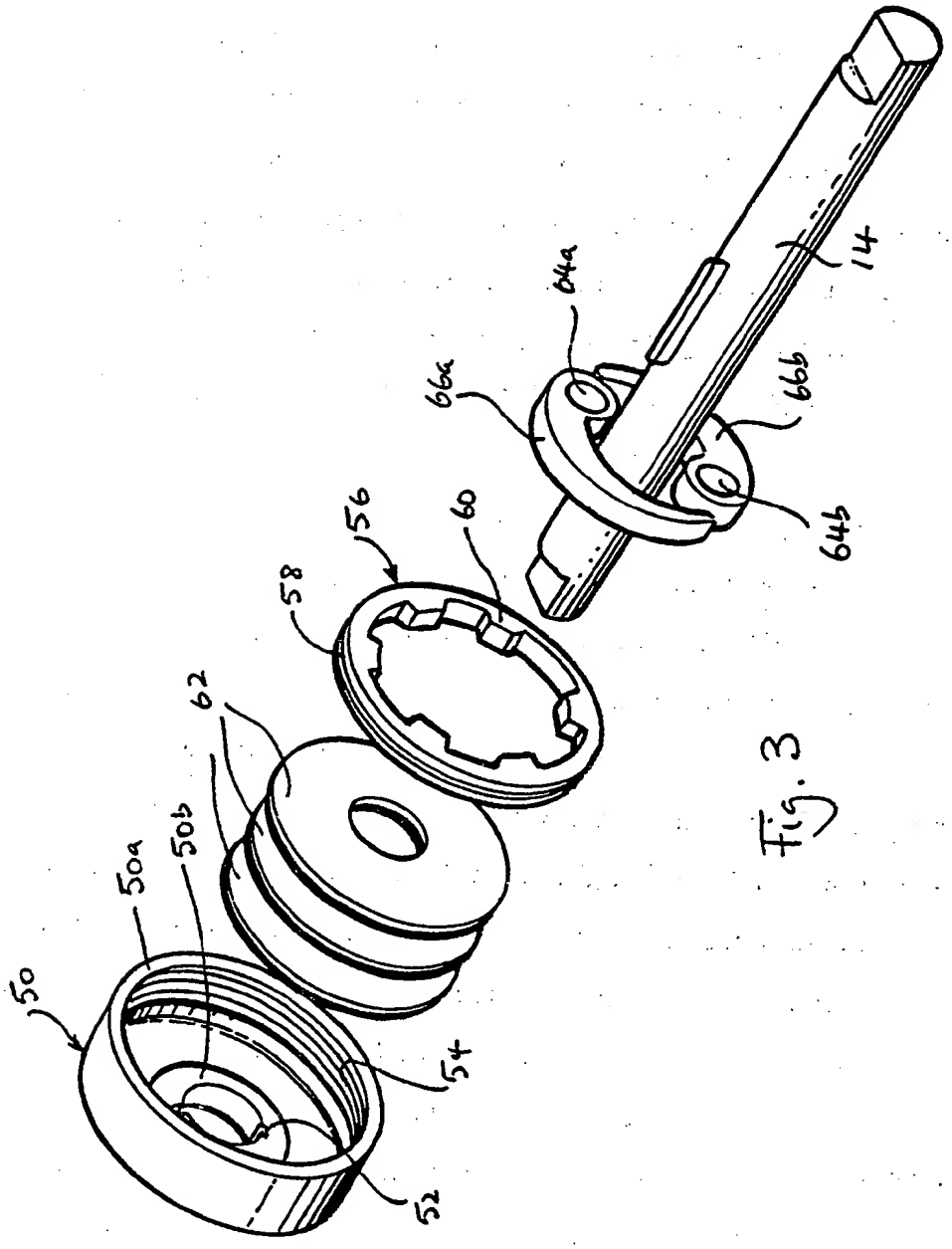

Fig. 3

DESCRIPTION

FALL ARREST DEVICE

The present invention relates to fall arrest equipment for protecting operatives working in hazardous locations and is concerned in particular with fall arrest devices of the type wherein a steel or synthetic lifeline is wound on a rotatable drum contained in a hollow metal housing. The lifeline, which in use is attached to an operative, can be withdrawn slowly from the drum and in so doing causes a coil spring in the housing to be wound up. If the tension on the withdrawn lifeline is released, then the spring causes the drum to be rotated so that the lifeline is retracted onto the drum. However, if the speed of withdrawal of the lifeline from the drum exceeds a predetermined rate - as would be the case if the operative had fallen from his working position, then in known arresters of this type the drum is arranged to be brought to a halt so as to prevent the operative from falling further. In some cases, the fall arrest equipment includes a ratchet mechanism on the housing which can be rotated manually by a handle to enable the drum to be turned to wind back the lifeline, and hence the operative secured thereto.

One problem with the known equipment is that in the event of the operative falling and actuating the

fall arrest mechanism, the operative is held by the equipment in a suspended position, from wher eventually he/she has to be released.

In some situations, there would be advantage in allowing the operative to be automatically lowered in a controlled manner in the event of a fall, rather than being arrested and held suspended by the equipment.

It is thus a principal objective of the present invention to provide a fall arrest device wherein, in the event of the device being actuated to arrest a fall, an operative connected to the device is allowed to be lowered in a controlled manner, unless a predetermined rate of descent is exceeded.

In accordance with the present invention, there is provided a fall arrest device comprising a main drum journalled within a housing and carrying a lifeline which can be withdrawn from and returned to the drum against and by a spring, respectively, and further comprising a sub-shaft journalled in the housing and adapted to be coupled to the drum for rotation therewith only in one direction of drum rotation corresponding to withdrawal of lifeline therefrom, the sub-shaft carrying a centrifugally acting brake which serves to control the speed of rotation of the sub-shaft and hence of the

main drum.

Preferably, the brake comprises a pair of brake shoes which can frictionally engage the inner peripheral surface of a cylindrical recess in or on the housing. The brake shoes preferably carry arcuate or segmental brake pads of friction material.

In one embodiment, the brake shoes are pivotally attached to a component fixed to said sub-shaft, the pivotal axes of the brake shoes being parallel to, but transversely spaced from, the rotational axis of the sub-shaft.

Preferably, the sub-shaft is arranged to be drivingly coupled to the main drum in said one direction of drum rotation by way of a pulley which is journalled on the same axis as the drum, the pulley having a first peripheral portion connectible to the drum by means of a ratchet pawl on the drum and a second peripheral portion in meshing connection with a toothed pinion on the sub-shaft.

In a preferred embodiment, the fall arrest device further includes a back-up means for stopping rotation of the drum in a controlled manner should the speed of rotation of the drum in said one direction exceed a predetermined magnitude.

Advantageously, the back-up brake comprises an annular ratchet ring having internal ratchet teeth

which are adapted to be engaged by one or more centrifugally acting pawls when said predetermined rotational speed of the drum is exceeded, whereby the ratchet ring is then rotated with the drum, the ratchet ring being in screw-threaded engagement with a fixed housing part whereby, after a certain relative rotation of the ratchet ring and housing part, the ratchet ring engages a stop to prevent its further rotation and thereby that of the drum.

Preferably, the stop is resilient so as to slow up the drum rotation gradually.

In one embodiment, the stop comprises one or more metal discs which are radially distorted between the fixed housing part and the ratchet ring to effect said resilient stop.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a diagrammatic, sectional side view of one embodiment of a fall arrest device in accordance with the present invention;

Fig. 2 is a front view of the fall arrest device of Fig. 1; and

Fig. 3 is a perspective exploded view of part of the control mechanism of the embodiment of Figs. 1 and 2.

Referring first to Figs. 1 and 2, the illustrated fall arrest device comprises a hollow housing 10 having a handle part 12 by which the housing can b anchored in its operational position. Non-rotatably fixed within the housing 10 is a main shaft 14 on which there is freely rotatably journalled a main drum 16. Wound around the drum 16 is one end of a steel or synthetic lifeline 18 whose other end extends out of the housing 10 via a housing aperture 20. Disposed within the drum in a conventional manner, there is a coil spring 22 which is adapted to be stressed when the lifeline is drawn off the drum 16 whereby to act to retract the lifeline back onto the drum when the tension in the lifeline is subsequently reduced. Thus, in use, the lifeline can be drawn and returned to the drum to allow the operative freedom of movement in his/her work.

Also freely rotatably journalled on the fixed shaft 14 is a double pulley 24 having a first portion 24a whose periphery carries ratchet teeth at 26 which co-operate with a ratchet pawl 28 pivotally mounted on the main drum 16 whereby, when the main drum 16 is rotated in the direction to wind lifeline 18, the pawl 28 is drivingly connected to the pulley portion 24c to cause the pulley 24 to rotate correspondingly. On the other hand, when the main drum is rotated in the

opposite direction by the spring 22 to wind lifeline 18 back onto the drum, the ratchet 28 rides over the toothed periphery of the pulley portion 24a and no corresponding rotation of the pulley 24 occurs.

The pulley 24 includes a second portion 24b carrying peripheral teeth 30 which are in permanent meshing engagement with teeth 32 on a sub-shaft 34 which is journalled in bearings 36a, 36b, 36c in the housing 10. The axis of the shaft 34 lies parallel to that of the main shaft 14. Rigidly fixed to the sub-shaft 34 is a plate 38 to which two centrifugal brake shoes 40a, 40b are pivotally mounted on respective axes 42a, 42b disposed transversely of the axis of the sub-shaft 34. The brake shoes 40a, 40b carry respective arcuate brake pads 44a, 44b which lie within a cylindrical braking surface 46 defined within a housing projection 10a.

The latter mechanism is arranged to operate such that when the drum is rotated in the direction to draw off lifeline 18, the pulley is rotated correspondingly by way of the ratchet 28. Rotation of the pulley is transmitted to the shaft 34 via the meshing teeth 30, 32 but with a speed magnification resulting from the relative diameters of the pulley portion 24b and shaft 34. Rotation of the shaft 34 rotates the plate 38 and hence the centrifugal brake shoes 40a, 40b. Above a

certain speed of rotation, the brake shoes are thrown out centrifugally such that the brak pads engage the cylindrical braking surface 46 and act to restrict the maximum speed of rotation of the main drum 16 to an acceptable level. By this means, if the operative attached to the lifeline 18 should fall, he/she is allowed to descend relatively slowly in a controlled manner under the braking action of the brake pads 44a, 44b.

The presently illustrated fall arrest device also includes a back-up mechanism by which the descent of an operative is halted in a controlled manner should the abovedescribed controlled descent mechanism fail to operate correctly and would otherwise permit the operative to descent faster than said acceptable level.

Referring to Figs. 1 and 3, the device includes a cup-shaped housing 50 which is keyed to the main shaft 14 at 52 so that it is effectively fixed and non-rotatable relative to the housing 10. An outer flanged part 50a carries an internal peripheral screw-thread 54. Disposed within the housing 50 is an annular ratchet ring 56 having a peripheral screw-thread 58 in meshing engagement with the screw-thread 54 on the housing 50. The inner periphery of the annular ratchet ring 56 carries inwardly directed

ratchet teeth 60. Loosely mounted around the shaft 14, between a central boss portion 50b of the housing 50 and the ratchet ring 56, are a number of annular metal discs 62 (three in this example). Disposed within the annular ratchet ring 56 and pivotally attached to the main drum 16, at 64a, 64b are two spring loaded centrifugal pawls 66a, 66b.

The latter mechanism is adapted to operate as follows.

For normal rotatable speeds of the main drum 16 below said acceptable level, the centrifugal pawls 66a, 66b cannot overcome the biassing action of their springs sufficiently for these pawls to engage the teeth 60 on the ratchet ring 56 and the mechanism is unoperational. However, should the acceptable level of rotation of the drum 16 be exceeded, for example, by failure of the abovedescrived braking arrangement, then the centrifugal pawls 66a, 66b are arranged to fly out sufficiently to engage the ratchet ring 56 whereby the ratchet ring is then rotated in sympathy with the main drum 16. Rotation of the ratchet ring 56 causes it to be wound along the screw-thread 54 in the housing 50 so that it is displaced axially towards the left, as viewed in Figs. 1 and 3. In so moving, the ratchet ring 56 engages the stack of metal discs 62 and causes these to be distorted over the central

boss portion 50b, ie the radially outer portions of the discs 62 are displac d to the left whilst the radially inner portions of these discs are fixed by their engagement with the boss portion 50b. The rotation of the ratchet ring 56, and hence the rotation of the main drum 16, is thus slowed down and eventually stopped when no further deflection of the discs 62 can take place. By this means, the descent of the operative is brought to a positive halt but in a controlled non-abrupt manner over typically a distance of one or two metres, thereby preventing or minimising the risk of injury to the operative which could occur with a braking action which is too abrupt.

The number of discs 62 is not restricted to three and can by any suitable number, including one.

CLAIMS

1. A fall arrest device comprising a main drum journalled within a housing and carrying a lifeline which can be withdrawn from and returned to the drum against and by a spring, respectively, and further comprising a sub-shaft journalled in the housing and adapted to be coupled to the drum for rotation therewith only in one direction of drum rotation corresponding to withdrawal of lifeline therefrom, the sub-shaft carrying a centrifugally acting brake which serves to control the speed of rotation of the sub-shaft and hence of the main drum.

2. A fall arrest device as claimed in claim 1, in which the brake comprises a pair of brake shoes which can frictionally engage the inner peripheral surface of a cylindrical recess in or on the housing.

3. A fall arrest device as claimed in claim 2, in which the brake shoes carry arcuate or segmental brake pads of friction material.

4. A fall arrest device as claimed in claim 2 or 3, in which the brake shoes are pivotally attached to a component fixed to said sub-shaft, the pivotal axes of the brake shoes being parallel to, but transversely spaced from, the rotational axis of the sub-shaft.

5. A fall arrest device as claimed in any of

claims 1 to 4, in which the sub-shaft is arranged to be drivingly coupled to the main drum in said one direction of drum rotation by way of a pulley which is journalled on the same axis as the drum, the pulley having a first peripheral portion connectible to the drum by means of a ratchet pawl on the drum and a second peripheral portion in meshing connection with a toothed pinion on the sub-shaft.

6. A fall arrest device as claimed in any of claims 1 to 5, which further includes a back-up brake means for stopping rotation of the drum in a controlled manner should the speed of rotation of the drum in said one direction exceed a predetermined magnitude.

7. A fall arrest device as claimed in claim 6, in which the back-up brake comprises an annular ratchet ring having internal ratchet teeth which are adapted to be engaged by one or more centrifugally acting pawls when said predetermined rotational speed of the drum is exceeded, whereby the ratchet ring is then rotated with the drum, the ratchet ring being in screw-threaded engagement with a fixed housing part whereby, after a certain relative rotation of the ratchet ring and housing part, the ratchet ring engages a stop to prevent its further rotation and thereby that of the drum.

8. A fall arrest device as claimed in claim 7, in which said stop is resilient so as to slow up the drum rotation gradually.

9. A fall arrest device as claimed in claim 7 or 8, in which said stop comprises one or more metal discs which are radially distorted between the fixed housing part and the ratchet ring to effect said resilient stop.

10. A fall arrest device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
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Relevant Technical fields

(i) UK Cl (Edition K) B8B BCCC A5A A44

(ii) Int CL (Edition 5) B66D A62B

Search Examiner
B J THOMAS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
28 AUGUST 1992

Documents considered relevant following a search in respect of claims 1-10

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 999553 (TROVIN) see Figure 1 and page 1 lines 59-64	1-4

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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